Summer 1991

Adequate Water Supply Study

Jacksonville Community Council, Inc.

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A Report to the Citizens of Jacksonville ■ Summer 1991

SCOPE OF STUDY

With water so obviously plentiful in Northeast Florida, concern about ensuring an adequate supply of potable or drinking water may seem superfluous. Yet concerns are justified for both the quantity and the quality of the water supply. As the population and economy of Northeast Florida continue to grow, increasing demands for water will magnify these concerns.

The purpose of this study is to ascertain the present and future adequacy of Northeast Florida's potable water supply and to recommend actions which will ensure its continued adequacy. To fulfill this purpose, the study:

- identifies the major sources of potable water in Northeast Florida, assesses their limits, and identifies potential dangers to maintaining their quality and quantity;
- catalogs the major uses and users of water from these sources, as well as the trends in water use;
- discusses the costs and prices of water, including the rate structures charged by water utilities;
- describes the multiple facets of governmental regulation of the quantity and quality of potable water;
- discusses strategies and programs for water conservation; and
- considers the need for planning now for possible alternative sources of potable water.

The study concludes with recommended actions designed to ensure that Northeast Florida's potable water supply will continue to be adequate into the future.

HIGHLIGHTS

Major Problems

Inadequate information to evaluate accurately how much water is and will be available, and how much can be withdrawn without endangering the water resource.

Lack of common knowledge among water users about the potential limits and true costs of the potable water they use and perhaps waste.

Multiple public regulatory agencies with confusing and overlapping responsibilities.

Inadequate coordination among agencies regulating water in Northeast Florida.

Water-utility rate structures which reward greater consumption rather than conservation.

Recommended Solutions

Increased research, more comprehensive data collection, and timely dissemination of information for use in water planning and conservation programs.

More effective and coordinated planning for enhanced conservation programs.

Legislative action to clarify and simplify governmental regulation of water quality and quantity.

Mutual establishment by regulatory agencies of a regional water-resources coordinating council.

Adoption by water utilities of rate structures which provide incentives for conservation.

FINDINGS

Findings represent the data base of the committee. They are derived from published materials, from facts reported by the resource people, and from a consensus of committee understanding of the opinions of resource people.

Adequate Supply

An adequate supply of potable water is essential for human survival. In Northeast Florida, an abundant supply of high-quality potable water is presently available. The question is how to ensure that the water supply continues to be adequate into the future.

Potable water is water which is safe for drinking by humans. It may be naturally potable, or it may be chemically or physically treated to make it potable.

Northeast Florida is blessed with abundant water. It falls frequently from the skies; it flows copiously in streams and rivers; it lies in numerous swamps and lakes, and it rises and falls along the ocean coastline. In addition, great quantities of water are held in rock formations beneath the land surface.

The technology is available to collect water from any of these sources, treat it to potable standards, and distribute it for human consumption. In this sense, an adequate supply of potentially potable water will always be available.

Currently, most people in Northeast Florida drink water which comes from an abundant and high-quality source deep underground. The primary question in this study concerns how to ensure an adequate supply of potable water from this source well into the future. Secondarily, the study considers potential alternative sources, should the current source become inadequate.

Sources

Northeast Florida's potable water comes from groundwater aquifers which supply some of the most plentiful and pure water available anywhere. But even this valuable resource is potentially limited, both in quantity and quality.

At present, virtually all water used in Northeast Florida for potable purposes comes from groundwater, that water which is stored in the sponge-like rock and sand formations beneath the land. Huge quantities of groundwater are available, much of it naturally potable or near-potable. This source represents one of the most prolific and pure sources of water in the world. Because of its availability, no other sources of water have been needed for potable use in this area.

Groundwater is obtained through wells which are drilled to appropriate depths. Two major zones of groundwater exist beneath the land. These zones are referred to as aquifers.

Shallow Aquifers

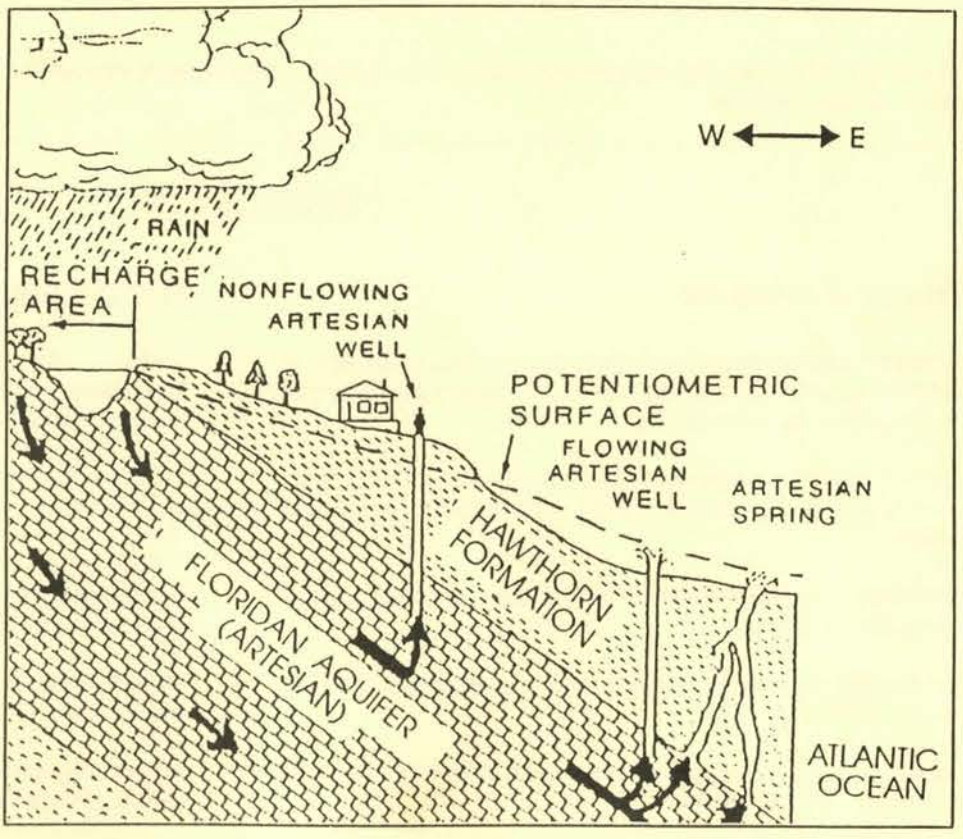
A number of shallow aquifers exist in layers of sand and porous rock to a depth of about 150 feet below the surface. The quantity of water available from shallow aquifers differs from place to place, depending on the sand and rock structures beneath.

The quality of water from these sources also varies. Since the aquifers are supplied by rainfall, the water is naturally potable. Because it is relatively near the surface, however, the water is susceptible to contamination from pollutants. Along the coast, if large quantities of water are pumped out, shallow aquifers are susceptible to lateral intrusion of salt water from the ocean.

Beneath these shallow layers in most areas is an impermeable layer of clay called the Hawthorn Formation. This layer is a barrier rather than a sponge for water. It acts as a floor beneath which shallow groundwater (and possible contaminants) cannot seep. It also acts as a ceiling for the deep aquifer below.

The Floridan Aquifer

The deep aquifer supplying Northeast Florida is called the Floridan Aquifer. It is a



massive formation of limestone, beneath the Hawthorn Formation, which extends from east-central South Carolina to east-central Florida. The upper 1,000 to 1,300 feet of this formation is saturated with fresh water. Below that, the groundwater is saline, containing salt and other dissolved minerals. Although the fresh water also contains some minerals, primarily dissolved lime and sulphur, it has a very low salt content and is easily made potable by aeration to remove the sulphur. The Floridan Aquifer is the source of most potable water in Northeast Florida.

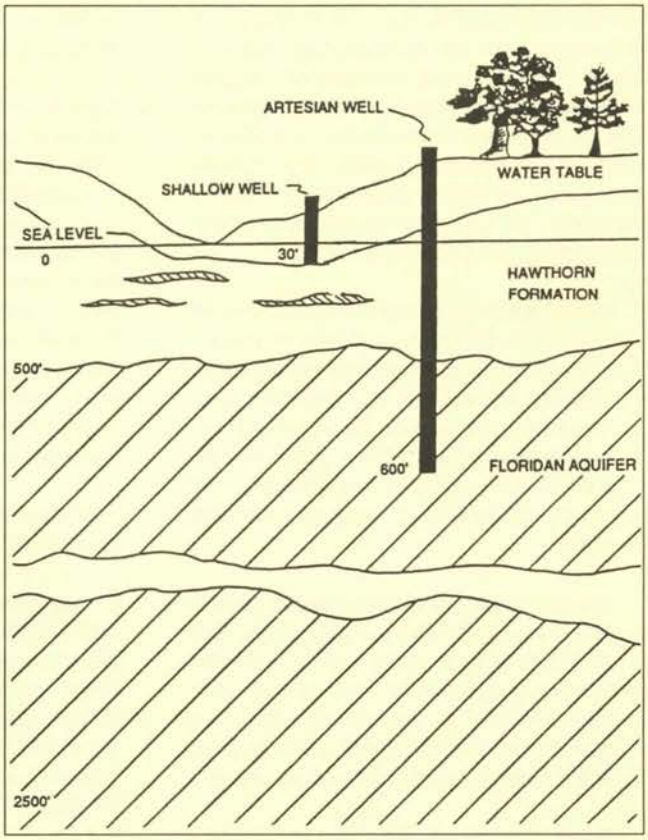
The rock formations do not lie horizontally beneath Northeast Florida. They dip downward from southwest to northeast. Along the Atlantic coast in Nassau and Duval Counties, the top of the Floridan Aquifer is more than 500 feet beneath the surface. However, in southwestern Clay, Putnam, and Alachua Counties, Floridan-Aquifer rocks reach the surface.

These areas to the southwest of Jacksonville, as well as some to the northwest in Georgia, are important for the replenishment of Floridan-Aquifer water through rainfall. Called recharge areas, these are the locations where rain water can seep directly into the Floridan Aquifer. As much as 20 inches of rainfall annually can be absorbed into the Floridan Aquifer in high recharge areas. The remaining 30 or more inches of average annual rainfall still runs off into streams, lakes, and the ocean. Because of the Hawthorn Formation, little recharging occurs in coastal areas of Northeast Florida, including Duval County.

The Hawthorn Formation is also responsible for the artesian, or free-flowing, character of Floridan-Aquifer water along the coastal counties in Northeast Florida. The northeastward dip of the Hawthorn Formation forces Floridan-Aquifer water further and further below its natural level in relation to the recharge areas to the southwest.

When a well is drilled through the Hawthorn Formation, the pressure is released, allowing water from the Floridan Aquifer to flow freely, seeking its natural level (technically called the potentiometric surface), which along the coast is many feet above sea level. Not all artesian flow occurs in man-made wells. A large number of natural springs in Northeast Florida allow millions of gallons of Floridan-Aquifer water to flow daily into streams and rivers.

Water within the Floridan Aquifer seeps laterally through the rock structures, but only very slowly. For instance, water in the Floridan Aquifer under western Duval County would take thousands of years to seep to a position under the Atlantic coast. If water is withdrawn gradually from dispersed wells, and if adequate rainfall in recharge areas continues to replenish the Floridan Aquifer, the fresh-water sponge remains full.



In recent years, rapid population and economic boom concurrent with an extended period of drier weather have raised the question of whether the Floridan-Aquifer sponge is indeed remaining full. The combined effects are causing measurable decreases in well levels, some of which are now at their lowest levels in the 50 years during which records have been kept.

With increased use of Floridan-Aquifer water, two negative effects may result. First, if the amount of water withdrawn substantially exceeds the amount being replenished by rainfall, a gradual lowering of the water level in the Floridan Aquifer may begin to occur. This causes the declines observed in well water levels.

Second, if large amounts of water are withdrawn rapidly in a small geographic area, lateral seepage may not be rapid enough to preclude vertical salt-water intrusion from below into the fresh-water zone of the Floridan Aquifer. This intrusion can make the Floridan-Aquifer water in the immediate area nonpotable without expensive treatment.

South of St. Augustine, increasing human water use and a large natural-flowing spring just off the coast have combined to produce extensive salt-water intrusion. In eastern Duval County, especially along the St. Johns River and the Atlantic coast, where geologic faults may contribute to it, some Floridan-Aquifer wells are experiencing salt-water intrusion. Salinity may increase in these wells only gradually. However, if water continues to be withdrawn rapidly, the salt content can exceed the State of Florida's regulatory limit for potability of 250 parts of chloride per million, as has already occurred in several wells.

Additional areas exist in Northeast Florida where intensive water use has substantially lowered the Floridan-Aquifer water level locally but has not yet caused salt-water intrusion. One such area runs from downtown Jacksonville along the St. Johns River to Green Cove Springs. Reduced Floridan-Aquifer water levels in this area are associated with intensive urban water use to the north and with free-flowing springs to the south. Another area is concentrated at Fernandina Beach, the result of water use by two large paper mills. Several years ago, these industrial users began taking water-conservation initiatives which have stabilized and even slightly increased Floridan-Aquifer water levels in this immediate area.

Users and Uses

Although most Floridan-Aquifer water is potable, much of it is used for purposes which do not require potability.

The St. Johns River Water Management District (SJRWMD) conducts an annual inventory by county of groundwater and surface-water

use in Northeast Florida. The inventory divides water uses into several categories. For some of these, actual consumption figures are available from reports. For other categories, consumption is estimated. In addition, small commercial, industrial, and agricultural users, as well as small utilities, are not included. The defined categories and their sources of data are as follows:

- **Public supply**: all uses by those whose water is supplied by a public or private utility company, including commercial, industrial, agricultural, and residential uses by these consumers. (In Duval County, residential use represents about 60 percent of the supply in this category and about 32 percent of total groundwater use.)

  Average daily residential use per person in Duval County is about 75 gallons. This is normally split about evenly between internal use, such as food preparation, dish washing, shower taking, and toilet flushing, and external use, such as lawn and garden irrigation and car washing.

  Many internal, residential uses require potability, but most external uses do not, although they do require fresh water. In addition, many of the commercial, industrial, and agricultural uses of public-supply water do not require potability. All local public-supply water is treated to be potable, and virtually all of it is withdrawn from the Floridan Aquifer.

  Inventory data come from monthly reports of actual use.

- **Domestic self-supply**: residential uses by those whose water comes from a private well. Most such wells tap shallow aquifers, although some reach to the Floridan Aquifer. This water is not treated, so it is usable for internal, residential use only so long as it remains naturally potable.

  Inventory data are estimated based on public-supply figures.

- **Commercial/industrial self-supply**: uses by commercial, industrial, and institutional consumers who have their own wells. Many industrial uses, such as operating boilers, require fresh water, but few require potable water. Most of these users' wells tap the Floridan Aquifer in order to obtain sufficient quantities of water.

  Inventory data come from monthly reports of actual use.

- **Agricultural irrigation**: commercial agricultural uses of water by consumers with their own water sources, including crop irrigation, freeze protection, and golf-course watering, but excluding residential lawn and garden watering. Most of these uses require fresh but not potable water. Where available, surface water from lakes and rivers is used. However, most consumers depend on wells, and in many cases Floridan-Aquifer wells are required because the flow rates of shallow wells are insufficient.

  Inventory data are estimated based on acres irrigated and crop types.

- **Power generation**: all water uses connected with electric-power generation, including steam production and cooling. Fresh, but not potable, water is required for producing steam. Brackish water can be used for cooling. The Jacksonville Electric Authority uses surface water from the St. Johns River for cooling purposes.

  Inventory data come from monthly reports of actual use.

- **Miscellaneous**: uses connected with heat-pump and air-conditioner operation, free-flowing wells, and other miscellaneous uses. None of these uses requires potable water, although fresh water may be needed. Heat pumps often use shallow-aquifer water. Abandoned Floridan-Aquifer wells flow freely because of artesian pressure, if not capped.

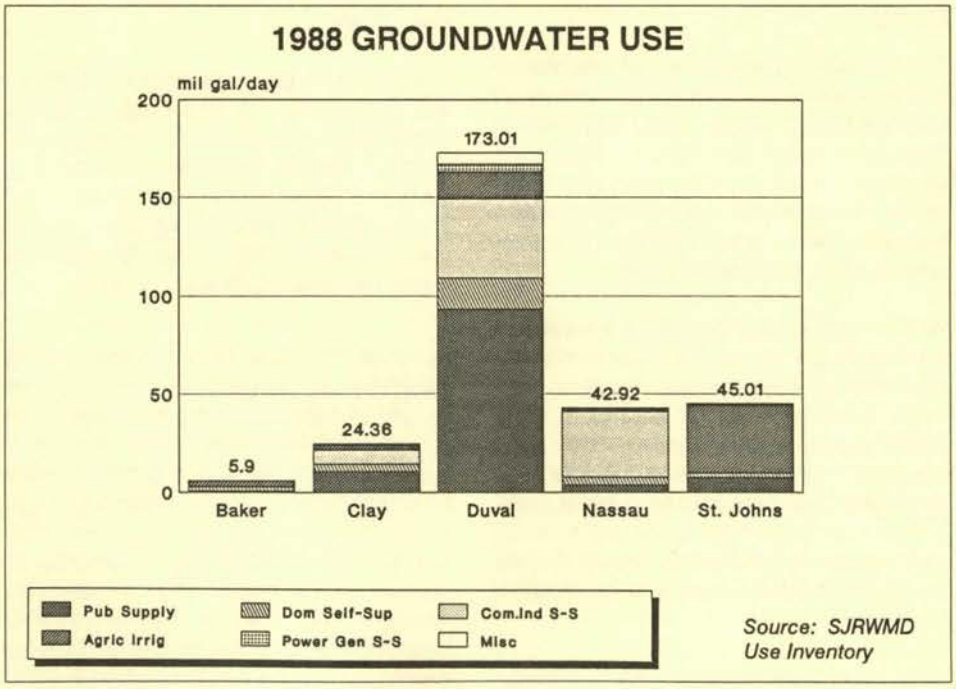
  Inventory data are estimated based on formulas.

Water uses differ among Northeast Florida counties; Duval County consumes more than half of all the water used.

Despite the estimation and the exclusions, this inventory provides an indication of the amount of water being used and the relative use by different categories of consumers. The most recently available figures are for 1988.

In Northeast Florida, water consumption in Duval County far exceeds that in the surrounding four counties combined. In 1988, Duval County's consumption of surface and groundwater represented 86 percent of total consumption in the five counties. Its groundwater consumption represented 59 percent of the five-county total.

The largest users of fresh groundwater differ from county to county. In Clay and Duval Counties, public supply is the largest user category; in Nassau, it is commercial/industrial (the paper mills); and in Baker and St. Johns, agricultural irrigation is the largest category.



Source: SJRWMD Use Inventory

Data on long-term water-use trends are not available. Since 1975, water-consumption trends have varied substantially among Northeast Florida counties.

Trends in total water use are as important as relative use by category in understanding Northeast Florida's water needs. In the longer-term, population size and economic activity affect water use: New residents and new industries require new water. In the shorter-term, water-use practices and the weather influence water use: Wasteful water use increases demand, but conservation practices can reduce it. Both extended dry periods and brief freezes substantially increase water use.

Accurate long-term water-use trends are not known. The SJRWMD has compiled water-use data for only the period 1975 through 1988 and has made projections for 1995 and 2000. Data for 1989 and 1990 are not yet available.

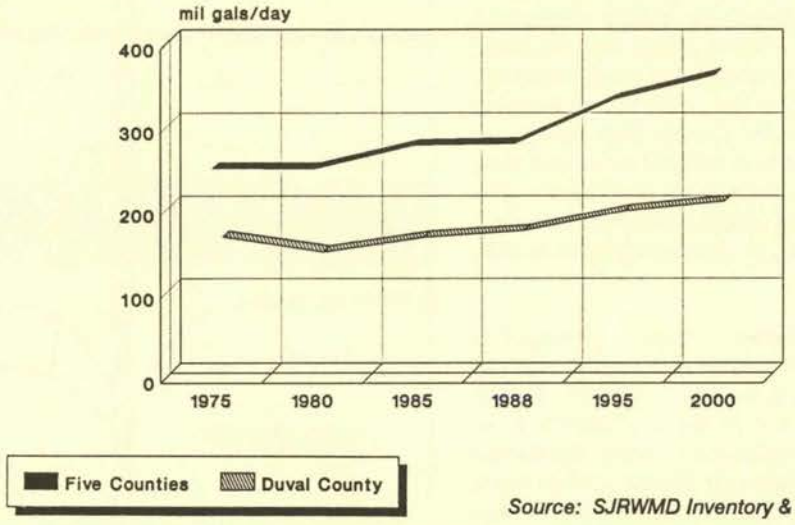
During this period, water-use trends have varied substantially among the counties in Northeast Florida. In Duval, total fresh-groundwater use actually declined from 1975 to 1980 but rebounded by 1985. Only since 1985 has it increased over its 1975 level, probably because of rapid population and economic growth.

In Nassau County, conservation efforts by the paper mills during the 1980s reduced the 1988 total to its 1975 level, reversing a major increase in the late 1970s. The steady increases in Baker and Clay County and the more abrupt increase in St. Johns County appear to reflect a combination of population growth and increased agricultural irrigation.

Water levels in wells provide an indirect measure of water use. They are an imprecise indicator of human use because they also reflect recent rainfall amounts. Although the influence of rainfall is less direct and immediate in Floridan-Aquifer wells than in shallow wells, some effect exists. Because the effects of increased human use and of reduced rainfall cannot easily be separated, interpreting recent decreases in Floridan-Aquifer well levels is difficult.

The water level in particular wells has been monitored in Duval County for as long as 50 years. Measurements are made of the "static artesian pressure level," which is the water level uninfluenced by pumping. Pumping from a well lowers its water level.

GROUNDWATER USE TRENDS
(Baker, Clay, Nassau, St. Johns)



Source: SJRWMD Inventory & Projections

In various monitor wells scattered around Duval County, Floridan-Aquifer well levels have declined between six inches and two feet per year over the last half century. These recorded declines appear to reflect both human-consumption and climatic factors. The rate of decline accelerated during the late 1980s, a period of both urban growth and low rainfall.

Quantity and Quality

Northeast Florida's sources of potable water are abundant but not unlimited. Technical experts disagree on how much groundwater actually is available and on the potential for depletion or degradation resulting from increasing human consumption.

If unlimited quantities of potable water were available from groundwater sources, an adequate supply of water could be said to exist for all present and future users, even if they were consuming potable water for uses not requiring potability. In fact, limits exist on the availability of potable water in Northeast Florida both from shallow aquifers and from the Floridan Aquifer.

Shallow-Aquifer Limits

Limitations of the water supply available from shallow aquifers are well known. In terms of quantity, this source is relatively small compared with the Floridan-Aquifer. Also, quantities vary from place to place, depending on local geology. Shallow aquifers provide potable water for many residences with private wells, but they are not an adequate source for high-volume consumers such as water utility companies or large commercial, industrial, or agricultural enterprises.

In terms of quality, this source is vulnerable to contamination from various pollutants introduced from the surface. Major potential contamination sources include:

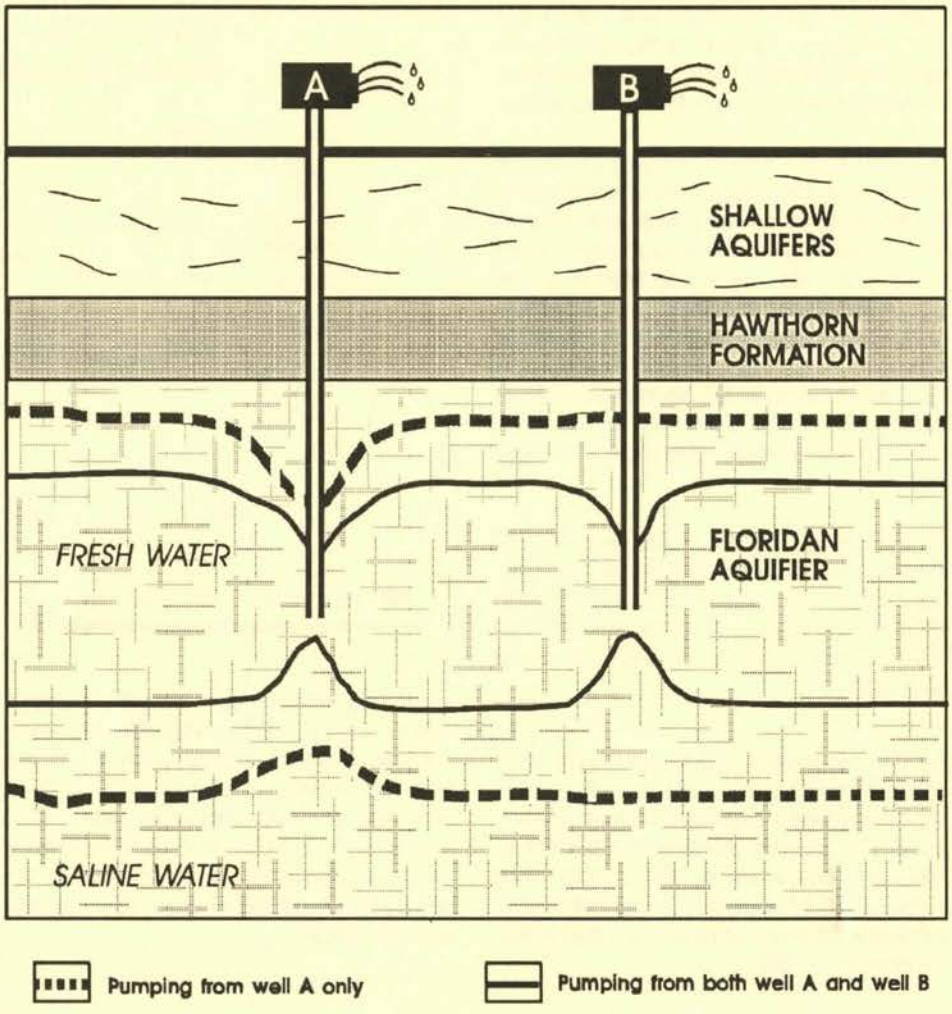
- **Septic tanks**: Thousands of Northeast Florida residents who rely on septic tanks (105,000 people with 80,000 septic tanks in Duval County alone) also have private, shallow wells. Septic tanks perform only low levels of treatment and frequently malfunction. Entire neighborhoods have older, obsolete septic tanks which provide inadequate treatment. A malfunctioning septic tank can readily contaminate a nearby shallow well.

- **Toxic-or hazardous-waste sites**: Sites where toxic or hazardous substances have been dumped or buried in the past are a major threat to surrounding shallow groundwater. Because cleaning up the underground pollution is extremely expensive, contamination of nearby wells usually makes them useless, requiring the substitution of utility-company water. Many sites have been identified in Northeast Florida (92 in Duval County). To date, 48 wells in Duval County have been seriously contaminated with toxic or hazardous substances.

- **Storage tanks**: Leaks from above or underground tanks or lines can contaminate nearby wells, often making them unusable. In particular, thousands of gasoline tanks are buried throughout Northeast Florida, many long forgotten under the sites of former service stations. About 600 of the 1,300 known gasoline tanks in Duval County have had leaks reported, and to date, 39 wells have been shut down because of gasoline contamination. Well contamination from this source is becoming an increasingly serious problem.

- **Old dump sites**: Pollutants from the sites of old, unregulated dumps may leak into nearby groundwater. Modern landfills can also pollute the groundwater if not properly maintained. Many old dumps exist in Northeast Florida (200 in Duval County). As old dumps are identified and contamination contained, this source of groundwater pollution should diminish. Modern landfills are more safely designed and are usually better maintained.

- **Stormwater runoff**: Runoff from rainfall washes away many pollutants left on the land. These pollutants include residues of heavy metals and petroleum-based substances, primarily from motor vehicles, as well as fertilizers, pesticides, and herbicides used in agriculture, golf-course maintenance, and lawn care. Most runoff pollutes surface waters. But beneath lakes and ponds, including thousands of small stormwater-retention ponds required by law, some of these pollutants may seep into the groundwater. While not a major source of shallow-well contamination, runoff pollution remains a potential threat.



Floridan-Aquifer Limits

The long-term decline in monitor-well levels in Duval County suggests limits on the quantity of the supply from the Floridan Aquifer. As already noted, climate, as well as human consumption, appear to affect the level of water in the Floridan Aquifer. However, the reasons for greater or lesser declines in particular wells and the relative influence of the current low-rainfall period versus increasing human water use are not clearly understood.

Static artesian pressure levels in many Floridan-Aquifer wells have been declining for at least 50 years. This means that the level at which these wells flow naturally has been declining. Still, pressure levels remain about 20 feet above sea level in the heavy-withdrawal areas of downtown Jacksonville and the beaches. This level is over 500 feet above the top of the Floridan Aquifer. If the long-term decline continues, artesian pressure in these areas could be reduced to sea level or below by sometime early in the next century. Technical experts disagree about whether this degree of gradual decline represents a threat to the Floridan-Aquifer water supply.

Without substantial increases in annual rainfall, continued increases in human water use will eventually drain the Floridan Aquifer of fresh water (or, more accurately, allow increasingly saline water to replace the fresh water). To date, technical experts have been unable to estimate accurately either the amount of fresh water in the Floridan Aquifer or the amount that can be withdrawn safely without seriously depleting the resource. If and when a safe-withdrawal amount is calculated, a process of water budgeting could be established to limit groundwater use consistent with the amount safely available.

The experts do know that a great quantity of water exists. It is not in imminent danger of depletion, but poorly understood dynamics of withdrawal could endanger it in the future, at least in certain areas. In the absence of a water budget, they advocate prudent conservation to ensure that this limited resource will continue to provide ample quantities of, potable water for Northeast Florida for as long as possible.

Except in recharge areas, the quality of Floridan-Aquifer water is not as vulnerable as that of shallow-aquifer water. In most other areas, the impermeable Hawthorn Formation protects the Floridan-Aquifer water from widespread contamination, although particular wells can still be contaminated at the well head. Even in recharge areas, contamination of Floridan-Aquifer water occurs mostly in the immediate vicinity of the pollution source and affects primarily water near the surface.

The most serious threat to the quality of Floridan-Aquifer water comes from salt-water intrusion. The potential for intrusion is directly related to the quantity of water withdrawn in a particular location. If withdrawal were increased on a massive, continuous scale, salt water would intrude into the entire Floridan Aquifer, and the fresh-water resource would be lost. In the short term, this is very unlikely to occur. Over a longer period, it might begin to occur gradually, if increasing human use required intensive, continuous water withdrawal over large areas.

At present, the increasing human use of water is not threatening massive intrusion. However, in particular areas, the heavy concentration of large Floridan-Aquifer wells already is allowing localized intrusion. The solution advocated by water-utility officials for this intrusion problem includes conservation coupled with the dispersed siting of large wells.

The paper mills in Nassau County have actively engaged in conservation to reverse a serious localized drop in Floridan-Aquifer water level caused by their enormous water consumption. In Duval County, some large public-utility wells concentrated along the beaches and in the Arlington area are beginning to experience intrusion. The water master plan now being developed for the Jacksonville public water utility will probably include plans for new, dispersed well fields in the western part of the county. Because these wells will be further removed from population centers than presently used wells, pumping this water to utility customers will increase the cost of water.

Another potential threat to the quality of Floridan-Aquifer water is the malfunctioning or improper use of deep injection wells. In some parts of Florida, such wells are used by wastewater facilities for the discharge of treated effluent deep beneath the earth. Because the geology of Northeast Florida is unconducive to the use of deep injection wells, none has received a permit or is expected to be approved.

The adequacy of Northeast Florida's potable-water supply cannot accurately be estimated solely in relation to water needs in Northeast Florida. Some regions, primarily in the South Florida and Tampa Bay areas, already are experiencing shortages of potable water. Water planners in these areas are contemplating a variety of alternative sources. At some point, the Floridan Aquifer beneath Northeast Florida may become an attractive alternative source for them. This possibility further heightens the potential limits of the Floridan-Aquifer water supply.

Costs

Potable water is inexpensive in Northeast Florida. Depletion or degradation of existing water resources may lead to increased costs.

The only direct costs water consumers in Northeast Florida incur to obtain potable water are those associated with withdrawal, treatment, and distribution. Consumers with private wells incur substantial initial costs for obtaining permits, drilling the well, and installing a pump and connecting pipes. The cost of ongoing operation and maintenance is minimal.

Based on the amount of water they use, consumers of utility-company water contribute toward paying the capital costs of purchasing land, drilling wells, and constructing treatment plants and distribution systems. They also pay for operation and maintenance of the utility system.

The *rates* utility-company customers pay do not necessarily reflect these direct *costs*. Some publicly owned water utilities finance certain capital costs through bond issues not fully repaid through rates. Others rely on water rates to generate general revenue for other governmental purposes.

The largest, local, publicly owned utility is the City of Jacksonville's Water Division. It is operated as a public enterprise, with a separate fund which receives water-rate payments and pays for the direct cost of the utility. Because rates have not been raised in about 15 years, water payments no longer cover full costs. The difference is currently being funded from retained earnings. A water-rate study, now underway, will recommend new rates designed to meet the full cost. Privately owned utilities also are run as separate enterprises, except that their rates include amounts for taxes and profit.

Water-utility rates and rate structures vary considerably across the country, making meaningful comparison difficult. Rates at any one time may also vary because of differing local circumstances. For instance, recent capital improvements may raise some utilities' rates, while the rates of others, like Jacksonville's, may remain the same for some time.

A 1990 survey of major municipal utilities reported charges for 1,000 cubic feet of water (7,480 gallons, or about a one-month supply for residential users). Charges ranged from a high of $22.95 in Nashville, Tennessee to a low of $3.66 in Dayton, Ohio. The average was $11.16, somewhat higher than the City of Jacksonville rate of $8.20. (Note that all of these water rates exclude any sewer-service charges).

Most water-rate schedules include lower cubic-foot rates for large water consumers, such as commercial and industrial establishments and apartment complexes. Increasing awareness of the need to conserve water is resulting in a rethinking of water rates, since current schedules tend to encourage more rather than less water consumption.

Some utility companies are instituting inverted schedules, whereby larger users pay higher rather than lower rates. The City of Jacksonville's water-rate study includes consideration of an inverted rate. The Florida Public Service Commission, which regulates privately owned utilities, is considering a rule change to allow inverted rates.

The City of Jacksonville public-utility rate of $8.20 was set in relation to the cost of providing potable water obtained from wells, located close to population centers, which tap the plentiful, high-quality Floridan-Aquifer water source. No other available source can supply sufficient quantities of potable water at such low cost.

A local engineering firm recently made calculations to estimate the increased direct cost of moving toward several different alternative sources of water. The goal defined was to reduce the water taken from wells in the Arlington and Beaches areas by about 75 percent by the year 2010. Concentrated withdrawal, possibly combined with the effect of geologic faults, has caused some salt-water intrusion in these areas. The figures listed in the box on page 8 reflect estimated increased costs, in 1990 dollars, over the current $8.20 for 1,000 cubic feet of water, taking into account expected population and economic growth.

The additional cost of using ocean water was not calculated, since it would be much higher, and several less expensive alternatives are available.

All of these costs and calculations assume that the cost of the water itself is zero. Economists maintain that a hidden but real cost is

Alternative water source	Cost increase over current rate per 1,000 cubic feet
New Floridan-Aquifer wells located in western Duval County: no change in treatment process; includes cost of pumping to treatment plant.	$ 1.49
Fresh water from St. Johns River south of Buckman Bridge: no change in treatment process; includes cost of pumping to treatment plant.	$ 2.81
Brackish water from St. Johns River downtown: treatment process to include reverse osmosis for removal of salinity; no new pipes or pumping necessary.	$ 6.13
Note: the same cost increase would apply to using shallow-aquifer water, if quantities were sufficient.	

Source: Simulation models developed by staff at Smith & Gillespie Engineers specifically for this study.

involved in the use of any limited resource, the cost of not being able to use it for another purpose, now or in the future. Although Floridan-Aquifer water is ultimately replenishable by rainfall, it is clearly a limited resource: Only a limited quantity can be withdrawn in any one place before reduced water levels and salt-water intrusion cause problems.

The pricing of water reflects society's view of the resource. Traditional utility rates reinforce the notion that water is free; using more of it should cost less per unit consumed, because per-unit production costs are reduced. Recent proposals to institute inverted rates reflect a different view: The water resource is limited, conserving it is important, and consuming more water should cost more per unit, regardless of the direct cost of production.

The widely differing market prices that people are able (or willing) to pay for water and for other beverages also reflect the perceived value of potable water. One set of calculations reveals that for 1,000 gallons, consumers pay $1.05 for City of Jacksonville tap water, $1,500 for bottled water, and $3,000 for soft drinks. From this perspective, public-utility water, not to mention private-well water, is a low-cost resource that many people may take for granted.

Regulation

To protect the quantity and quality of potable water, several governmental agencies are charged with regulating various aspects of human water use. Although regulations serve an important purpose, complying with them is often burdensome and costly.

Society has a strong interest in maintaining an adequate supply of potable water. Recognizing the limits of available water resources, it has established mechanisms to regulate, in the public interest, the quantity, quality, and cost of potable water. Because of the complexities of such regulation, the laws, rules, and bureaucracies involved have become entangled and intertwined. Sorting out the tangle is difficult but important for understanding whether existing regulation is working effectively for the benefit of the public.

Underlying the regulation of water in Florida is a basic legal principle: Unlike land, *water cannot be privately owned*. The groundwater under all Florida land is owned in common by all the people. Because it is not privately owned, it can be regulated for the common good through state government.

According to this principle, landowners may withdraw and use water from the ground only with state permission and only within the limits stipulated in permits issued by the state. Private wells used for domestic purposes represent the only statutory exception. Property owners may use water from shallow or deep wells on their own property for their own private purposes with no regulation from the state.

The principle of common water ownership may facilitate the withdrawal of water from a water-rich area to be used in a distant, water-poor area, if cost factors make it desirable. For instance, Pinellas and Hillsborough Counties both pump water from well fields in Pasco County. The possibility exists that other water-short counties in South Florida may become interested in pumping water long distances from the Floridan Aquifer.

Imposition of this principle precludes use of marketplace incentives which could provide additional means of regulating water use in Florida. In some states, water rights may be bought, sold, or leased. A competitive market in water rights (supplemented by necessary regulatory provisions) can provide a useful mechanism for water conservation, by placing a value on the water itself. It can also provide a useful mechanism to help make decisions about the regional transfer of water from water-rich areas to water-poor areas.

The cost of water is determined by the source available, the cost of treating and delivering it to customers, and the cost of complying with regulations. The rates charged for water by utility companies are determined by public decision. For publicly owned utilities, rates are set by the local governments which own the utilities. Rates for privately owned utilities are set by the Florida Public Service Commission, which seeks to maintain reasonable rates in an industry lacking marketplace competition.

The governmental function of water regulation is supported by several others, including public-health protection, land-use regulation, research, and education. To understand how all these functions interact in an effort to ensure an adequate supply of potable water, the jurisdictions and responsibilities of several public agencies must be examined.

Water-Quality Regulation

The U.S. **Environmental Protection Agency (EPA)** enforces national laws concerned with water-pollution control and safe drinking water. EPA's mandate is to protect the quality of water. It sets standards for the treatment and delivery of potable water through utility systems, in order to ensure that each consumer's tap water is safe to drink. It also sets national standards for the treatment and discharge of sewage and industrial wastewater, in order to reduce surface-water pollution and the potential for groundwater contamination.

In most parts of the country, including Florida, EPA enforces these standards indirectly, through intergovernmental agreements with state and local agencies. State and local governments have the option to enact and enforce standards which are more stringent than those from Washington. Both Florida and Jacksonville have chosen this option for certain standards.

The Florida **Department of Environmental Regulation (DER)** enforces EPA's and the state's environmental standards, including standards for water quality. Specifically, DER regulates large water systems, whether publicly or privately owned, by requiring construction permits for new treatment plants and distribution lines and for extensions of existing distribution lines.

PUBLIC AGENCIES CONCERNED WITH POTABLE WATER

	Water-Quality Regulation	Public Health Protection	Water-Use Regulation	Water Production	Land-Use Regulation	Research/ Education
National	**EPA**					**USGS**
State	**DER**	**DHRS**			**DCA**	**UF**
Regional			**SJRWMD**		**NFRPC**	
Local	**EPB/WRD**	**CPHUs**		**JWD**	**JPD**	**FCES**

DER regulates only water systems which serve at least 25 people for 60 days or more or which have 15 or more connections. These include both water utility companies and enterprises with their own wells, even many small commercial ventures such as convenience stores and day-care centers.

The permits require that all water distributed meet the EPA and DER quality standards. Compliance is monitored through required, periodic reports of analyses done on both pre-treatment and post-treatment water. Analyses must be conducted by professionals licensed through the Florida Department of Health and Rehabilitative Services (DHRS). The cost of a water analysis, which runs as much as $1,800, can be a heavy burden, especially for small enterprises. More stringent standards expected soon from EPA may increase the cost.

If water analyses indicate violations of water-quality standards, DER can take enforcement action, including levying fines and going to court. If the quality of the natural water used has deteriorated, increased levels of treatment may be required. In most cases, a warning notice is sufficient to elicit compliance. Generally, the public water supply throughout the State of Florida meets an acceptable level of quality.

Until recently, DER also issued permits for water-system wells. Now it delegates the permitting of larger wells to the Water Management Districts (see page 10). In certain counties, including Duval County, it delegates all of its water-system and smaller well-permitting and enforcement authority to County Public Health Units (see page 10).

DER's interest in water systems and their wells is limited to the adequacy of their construction and maintenance, to ensure that the water withdrawn is not contaminated. It is not directly concerned with the quantity or uses of the water withdrawn.

DER also regulates wastewater systems. Permits are required for the discharge of wastewater from sewage-treatment or industrial operations, in order to control pollution of surface waters. EPA and DER discharge regulations are becoming increasingly stringent, raising the cost and reducing the options for acceptable discharges.

For sewage-treatment facilities, one alternative discharge method is to make highly-treated effluent available for reuse (see page 15). This reclaimed water can safely be used for nonpotable purposes such as irrigation of lawns, golf courses, and agriculture. DER has encouraged reuse for some time but has not required wastewater treatment plants to make reclaimed water available. A recently adopted rule requires all new discharge-permit applicants to conduct a reuse feasibility study. In addition, DER will require that reuse water be made available if requested in areas which the Water Management Districts define as "critical water supply problem areas." These are now being identified. Early indications suggest that much of the St. Johns River district may be included. Meanwhile, increasing numbers of SJRWMD consumptive-use permits contain a requirement that reclaimed water be used for nonpotable uses, if it is available.

The City of Jacksonville's **Environmental Protection Board (EPB)** and **Water Resources Division (WRD)** share local jurisdiction in Duval County for most water-quality regulation. Under the terms of a formal agreement with DER, their main function is to enforce national EPA and state DER environmental standards.

As a rule-making board, the EPB has the authority to enact environmental regulations which are more strict than national or state standards and to regulate water quality in ways not covered by national or state laws. The EPB's local potable-water regulations are contained in its Groundwater Resource Management Rule. The EPB also has enforcement authority, including issuing compliance orders, levying fines, and going to court.

The WRD is an administrative agency which assists the EPB with rule making and monitors compliance with environmental standards. It also has limited enforcement powers, including issuing citations and tickets for minor violations and litigating in court.

To protect the quality of potable water, the EPB and WRD are concerned with potential

CPHUs	Florida County Public Health Units
DCA	Florida Department of Community Affairs
DER	Florida Department of Environmental Regulation
DHRS	Florida Department of Health and Rehabilitative Services
EPA	U.S. Environmental Protection Agency
EPB	Jacksonville Environmental Protection Board
FCES	Florida Cooperative Extension Service
JPD	Jacksonville Planning Department
JWD	Jacksonville Water Division
NFRPC	Northeast Florida Regional Planning Council
SJRWMD	St. Johns River Water Management District
UF	University of Florida
USGS	U.S. Geological Survey
WRD	Jacksonville Water Resources Division

sources of groundwater pollution, primarily in shallow aquifers. The most important of these sources are septic tanks, dumps, underground gasoline tanks, and stormwater-retention ponds.

In addition, under a cooperative agreement with the SJRWMD, the WRD issues construction permits for Floridan-Aquifer wells in Duval County with diameters of less than six inches. The purpose of these permits is to ensure that well construction is adequate to protect the quality of the water source and of the water withdrawn from it. Because no renewal permits are required, and because consumption is not monitored, no regular means exists to enforce the continuing adequacy of permitted wells.

The WRD also promotes water conservation, primarily by working with other divisions of City government and other public agencies. For example, it helped to write the water-conservation sections of the comprehensive plan, and it is actively working to encourage water reuse. Through this function, the WRD is concerned with the quantity, as well as the quality, of potable water in Duval County.

Public-Health Protection

The functions of the **Florida Department of Health and Rehabilitative Services (DHRS)** include regulation of potable-water quality for the purpose of protecting public health. For many years, DHRS has issued permits to water systems for construction of water-treatment plants, distribution lines, and wells. It also monitors water in these systems and enforces compliance with drinking-water standards. These functions are carried out through **County Public Health Units (CPHUs)** which are local agencies of DHRS located in each county.

More recently, the Florida Legislature shifted authority for the regulation of large water systems--those serving 25 or more people for 60 days or longer or those with at least 15 connections--to DER. This shift was made to comply with an EPA requirement that each state designate a "primary agency" for environmental regulation, including water-quality regulation. DHRS continues to regulate small water systems.

The Legislature has provided a mechanism for the delegation of DER's water-system construction-permitting authority back to DHRS, on a county-by-county basis. DER may designate certain CPHUs with the necessary capabilities as "approved" to assume its authority within the county. The Public Health Unit in Duval County (actually the Environmental Health Division in Consolidated Jacksonville's Department of Health, Welfare, and Bio-Environmental Services) is the only approved CPHU in Northeast Florida. Until last year, DER could delegate only certain permitting functions. In 1990, the Legislature expanded the delegation to include all DER water-system permitting and enforcement functions. DER continues to regulate large water systems directly in nonapproved counties.

Only single, privately owned wells are exempt from DER or DHRS permitting. If one of these becomes contaminated, however, DHRS is authorized to investigate and, to protect public health, may order that it not be used.

Recently, CPHUs have become particularly active in investigating contamination problems surrounding toxic or hazardous waste-disposal sites. In Duval County alone, 524 private wells adjacent to 92 sites had been tested by the end of 1990. Contamination was found in 109 wells, 48 of which contained serious levels of contaminants.

State legislative proposals have been made to require construction permits for all wells, or at least to require water testing when new wells are drilled and when wells change ownership. None of these has been enacted. Many private-well owners oppose what they consider to be an invasion of their property rights.

Water-Use Regulation

The **St. Johns River Water Management District (SJRWMD)** is one of five Water Management Districts (WMDs) created by the State of Florida. Each WMD is governed by a nine-member board appointed by the governor and confirmed by the Senate. WMDs receive state funding, and they also levy property-tax revenues within their jurisdictions.

Statewide coverage of the WMDs dates from passage of the Florida Water Resources Act in 1972. The SJRWMD's jurisdictional boundaries approximate the limits of the surface drainage system of the St. Johns River, encompassing all or part of 19 counties in northeastern and east-central Florida.

The WMDs possess sole statutory power in the state to regulate the use of water. Water-use issues are directly related to ensuring the quantity of water--ensuring that sufficient amounts of fresh and potable water will continue to be available to meet future needs.

Since Florida law precludes controlling water use through a market in water-rights, the primary regulatory tool of the WMDs is the issuance of consumptive-use permits. The SJRWMD has chosen to issue permits for only the larger users of surface or groundwater. Generally, these are defined as users with six-inch wells or larger, those using more than 100,000 gallons per day, or those capable of withdrawing at least one million gallons of groundwater per day.

About 6,000 consumptive-use permits have been issued by the SJRWMD. The average time period is seven years, although a few have been issued for longer periods and some for as little as two years.

Ideally, these permits would be issued consistent with a "water budget" based on the known quantity of water available and the known quantity which can be used annually without endangering available water resources. As noted above, however, technical experts do not know the quantity of water in Northeast Florida's most prolific source of potable water, the Floridan Aquifer. Nor do they know how much can safely be withdrawn from it without running the long-term danger of widespread salt-water intrusion.

Lacking this knowledge, Florida law has made a policy decision that each consumptive-use permit should reinforce the principles of efficiency and conservation. By following these principles, the regulatory process is designed to preserve existing sources of potable water for as long as possible, regardless of how much water might actually be available.

The WMDs enforce these principles through three broad statutory criteria for approval of a consumptive-use permit. According to these criteria, the proposed water use:

- must be "reasonable beneficial;"
- must not interfere with other presently legal water uses; and
- must be consistent with the public interest.

Reasonable beneficial use is defined specifically in WMD regulations to address such subjects as:

- efficiency of the proposed water use;
- feasibility of conserving water and of using reclaimed water;
- danger of salt-water intrusion; and
- danger of water-quality deterioration resulting from the proposed use.

Because water is a limited resource, conflicts inevitably arise among potential users. In practice, the consumptive-use-permitting process often resembles conflict-resolution negotiation. Few permits are denied, because the permitting process usually allows competing parties (including the public interest, represented by the WMD) to reach an accommodation. This accommodation is detailed in the unique conditions of each permit.

Although the law requires consideration of the effect of only the proposed water use, staff generally try to consider the cumulative effect of the proposed use along with nearby uses. Their ability to do so is frequently limited, however, by inadequate broad-based information about the amounts and movements of water underground. When WMD staff must rely primarily on site-specific information presented by applicants, important cumulative effects of the proposed water use may be missed in the permitting process.

When accommodation cannot be reached through negotiation, various appeals procedures are available, beginning with an administrative hearing and ending in the Florida District Court of Appeals. These procedures are used only infrequently.

At present, the SJRWMD is unable to collect use data from all consumptive-use-permit holders. These data are needed, both for planning purposes and for enforcement of permit conditions. A proposed rule now under consideration would require all permit holders to install measuring devices and to report consumption periodically.

Beyond regulating ongoing water use through permits, the WMDs also have the statutory authority to impose special water-use restrictions during times of water shortage. Recent drought conditions have led the SJRWMD to declare a "moderate" water shortage in Northeast Florida.

The most visible restrictions imposed have limited the days and hours of lawn irrigation. Violating these restrictions is a second-degree misdemeanor, and various local law-enforcement bodies have joined the SJRWMD staff in issuing citations against violators. This approach generated some public ill will, especially since commercial, industrial, and agricultural users were not subjected to mandatory water-shortage restrictions. SJRWMD officials maintained that sufficient restrictions already had been imposed on these large users through consumptive-use permits, and that further restrictions could endanger their economic well-being.

These restrictions have been controversial also because they have been applied equally to water users with shallow-aquifer wells and those whose water is drawn from the Floridan Aquifer. Since protecting the Floridan Aquifer is the most important water-conservation consideration in Northeast Florida, and since owners of private, shallow wells are not otherwise regulated, applying the lawn-irrigation restrictions to them has seemed unfair to some. It may also provide a disincentive for using shallow-well water for nonpotable uses, such as irrigation, thus discouraging one possible means of conserving Floridan-Aquifer water.

SJRWMD officials have justified the uniform application of restrictions in three ways. First, they maintain that equity requires treating all residential users equally, regardless of the source of their water. Second, they state that the goal of the restrictions is to influence all water users to conserve, so the source of water is not important. Finally, they point out that enforcing restrictions which apply to some residents but not to others, depending on the source of water, would be practically impossible.

The SJRWMD goal for overall groundwater-use reduction in a moderate water shortage is 15 percent. If water-shortage restrictions reduced the publicly-supplied residential use in Duval County by the desired 15 percent, total groundwater use would decline by only about 5 percent. If private-well residential use is included, the total reduction is still only about 6 percent. Clearly, to reduce total water use by 15 percent, substantial reductions must be achieved in industrial, commercial, and agricultural, as well as residential consumption.

Actual overall water consumption since imposition of the water-shortage restrictions in August 1989 has increased, not decreased, throughout the water management district. SJRWMD officials do not know exactly why. They maintain that water still may have been conserved. Because the population and economy of Northeast Florida grew rapidly during this period, per-capita use may not have increased. Furthermore, no one knows how much water might have been used if the restrictions had not been imposed.

Regardless of the success of these restrictions, the SJRWMD intends to lift the water-shortage restrictions. In their place, regulations are being developed which will impose similar restrictions on all water users permanently. This is proposed to be accomplished by automatically granting to each individual user a permit to consume water, subject to the specified restrictions and penalties for violation.

This change of approach might appear to indicate either that a real water shortage never existed, or that a water shortage has become a permanent condition in Northeast Florida. In reality, the SJRWMD has simply changed strategies. The purpose remains the same, to educate the entire public about the need to conserve water and to reinforce behaviors which further that goal.

The strategy of imposing water restrictions by declaring a water shortage appears to have created some public resentment. The new strategy is intended to make conservation a way of life rather than an extraordinary imposition. Both strategies are based on the presumption that Floridan-Aquifer and shallow-aquifer water are limited sources of potable water and that whatever can be done to conserve them for as long as possible is positive.

Water Production

The **Jacksonville Water Division (JWD)** of the City's Department of Public Utilities operates the largest public water utility in Northeast Florida, serving about 470,000 people through 134,000 customer accounts. This is not a regulatory agency; rather, it must obtain permits from and comply with the rules of the various regulatory agencies.

From the JWD's point of view, two major problems make utility operation more difficult. The first is the multiplicity of regulatory agencies. EPA, DER, DHRS, EPB, and WRD regulate the quality of the water delivered to customers, while the SJRWMD regulates quantity through consumptive-use well permits. Despite these distinctions, some overlapping and unclear definitions of agency jurisdictions and responsibilities appear to exist.

Consolidation of water regulation could simplify utility operations. State legislation would be required for statutory consolidation. Lacking that, the major agencies concerned with water in Duval County have established an informal working group for coordination. Such coordination is needed not only among regulatory agencies but also among public and private utilities in the local area.

The second problem results from conflicts among regulations. These conflicts result from technical incompatibilities among policy goals. For instance, water-quality standards require that utilities disinfect water, usually with chlorine, while environmental regulations protect surface water by limiting the amount of chlorine that can be discharged into streams and lakes. Complying with both sets of regulations requires that water utilities precisely design and carefully maintain their treatment procedures.

The JWD is actively involved in planning for improvement and expansion of the public water utility. JWD staff contributed to several elements of the new Jacksonville comprehensive plan. A new water master plan is now being developed under contract. This plan will replace a 20-year-old plan which is obsolete. It will include both short-term operational plans and longer-term resource-development plans.

Local water planning is now inhibited by the lack of a comprehensive survey of water needs and sources. The SJRWMD is working on such a survey, which is scheduled to be available in July 1991. It also is conducting a study on minimum groundwater levels. JWD officials expect that these will not contain the level of detail necessary for their planning. They advocate developing a water data-collection and analysis capacity within Jacksonville City government.

The JWD engages in public education to promote understanding of water issues and water conservation. Utility officials strive to convey the message that conservation is the best way to preserve the high quantity and quality of Northeast Florida's water resource.

Although education is an important means of promoting conservation, JWD officials feel that economic incentives can be more effective. They favor establishment of an inverted rate structure, by which users of larger quantities of water pay higher per-unit rates. The current rate structure tends to encourage greater use by charging high-volume consumers less per-unit.

A study is now being conducted under contract to revise water rates for the first time in 11 years. The primary reason for the study is to reset rates to cover the full cost of operations and capital improvements, but it will also consider establishing an inverted rate structure.

Another means of conservation is the development of water-reuse capacity. The Public Utilities Department is planning to construct the distribution system necessary to make reclaimed water (highly treated wastewater) available from the Mandarin wastewater-treatment plant. The reclaimed water will be made available for irrigation purposes on lawns and golf courses in the Mandarin-Southside area. How the cost of delivering this water will be shared has not yet been determined.

Land-Use Regulation

Several comprehensive-planning agencies in Northeast Florida play roles in protecting water resources through land-use regulations. In the mid 1980s, the Florida Legislature passed new laws which require development of comprehensive land-use plans from the statewide level down to the local level.

A state master plan has been developed by the Florida **Department of Community Affairs (DCA)**; regional planning bodies, including the **Northeast Florida Regional Planning Council (NFRPC)**, have developed comprehensive plans for their areas; and local governments throughout the state have developed their own specific comprehensive plans. The **Jacksonville Planning Department (JPD)** worked for two years preparing a comprehensive plan for the largest local government in Northeast Florida.

Unlike previous planning laws in Florida, the new legislation contains strong provisions to ensure proper enactment and implementation of the comprehensive plans. DCA has final approval authority over all local plans. This is intended to ensure that all required elements are included, that the contents adequately meet local planning needs, and that the contents are consistent with regional and state plans.

At the local level, the plan must be formally enacted by elected officials as an ordinance with the force of law. Specific land-use and other regulations required to implement the plan must be developed and adopted as ordinances, within certain deadlines established by the state. Once the plan and regulations are enacted, the local government may make land-use changes only twice a year.

In addition, the plan must include a Capital Improvements element which identifies needed public infrastructure projects, including water-utility-system expansion and improvements. This element must include estimated costs and deadlines for each project.

Local governments in Northeast Florida have just recently completed their comprehensive plans and received DCA approval. Jacksonville's plan was adopted by City Council in September 1990 and went into effect immediately, although negotiations with DCA on certain aspects of the plan delayed final state approval. More recently, local governments have been busy developing and enacting the required regulations and ordinances. Jacksonville enacted most of these in May 1991.

Several of the elements in local comprehensive plans directly relate to water. These include a Potable Water element, a Natural Groundwater Aquifer Recharge element, and a Conservation/Coastal Management element.

The Potable Water element relates to planning, operation, expansion, and improvement of local public water utilities. Among the many objectives and policies listed in the Jacksonville Potable Water element are the following:

- developing a water-utility master plan by 1992;
- developing a water-resources management plan by 1993;
- enacting a wellhead-protection ordinance by April 1991;
- enacting a water-reuse ordinance by 1992;
- establishing and utilizing potable-water conservation strategies in City water facilities by 1991;
- revising the Building Code to require demand-reduction fixtures and low-water-use building techniques by 1992;
- revising landscape and tree-protection regulations to require low-water-use features and vegetation and water-conserving irrigation practices;
- enacting a water-conservation ordinance by 1992; and
- developing a water-conservation public-education program and implementing it by 1991.

The Natural Groundwater Aquifer Recharge element is concerned with protecting groundwater, in general, and aquifer recharge areas, in particular, through restrictive land-use regulations and other means. This element in Jacksonville's comprehensive plan includes the following among many objectives and policies:

- quantifying existing and future groundwater uses in the county at least every five years;
- utilizing the SJRWMD's Groundwater Basin Resource Availability Inventory for groundwater use and protection planning;
- developing and implementing a wellhead-protection program, following enactment of an ordinance by April 1991;
- developing and implementing a recharge-area protection program, if and when the SJRWMD identifies prime recharge areas in Duval County; and
- enacting a water-reuse ordinance by 1992.

The Conservation/Coastal Management element is concerned with the conservation of surface water and groundwater resources. Objectives and policies in the Jacksonville plan include, among others, continuing to maintain groundwater quality through regulation of well construction, septic tanks, public sewage treatment and discharge, and hazardous waste disposal.

Many of the water-related goals, objectives, and policies in local comprehensive plans are already required by other laws. The importance of the planning process may not lie primarily in the establishment of new initiatives. The most significant impacts may come from bringing disparate policies together in a comprehensive plan; from bringing officials in various public agencies together to implement these policies; and from making elected officials more aware and supportive of planning issues, including those related to potable water.

Two weaknesses in the comprehensive-planning process may inhibit implementation or divert from local priorities. In certain segments of the plan, one agency must await action by another before an important policy can be implemented. For instance, Jacksonville cannot develop a program for protection of Floridan-Aquifer recharge areas unless or until the SJRWMD has identified prime recharge areas in Duval County. Although this task was to have been completed in 1989, it remains in its early stages. Furthermore, since most or perhaps all of the prime recharge areas in Northeast Florida are located in counties to the south and west of Jacksonville, Duval County must rely heavily on the effectiveness of recharge-area protection by other local governments.

A second weakness results from the uniform application of comprehensive-planning requirements in diverse local areas. For example, requirements for wellhead-protection programs were designed with the many Florida communities in mind whose water supply comes from shallow groundwater sources, which are highly susceptible to contamination. Although Jacksonville's public water utility taps the Floridan Aquifer, which is not easily susceptible to contamination, Jacksonville still must develop and implement a wellhead protection plan which meets the state requirements.

Research and Education

Without knowledge about the extent, limits, and dynamics of potable water resources, the regulatory functions of government cannot be rationally planned or effectively enforced. Without education, those functions may not be understood and accepted by the public.

The **United States Geological Survey (USGS)** conducts research on both surface and groundwater resources. It did much of the early research on the Floridan Aquifer in Northeast Florida. More recently, the SJRWMD has become the most important source of water research in Northeast Florida. Its research is building on the knowledge base developed by the USGS.

The **Florida Cooperative Extension Service (FCES)** is an arm of the **University of Florida (UF)**, with local offices throughout the state. Its mission is educational, often using the knowledge gained from university research. Recognizing that many people are uninformed about and take for granted their source of potable water, FCES has expanded its education programs on water during recent years. The thrust of these programs has been to emphasize the precious nature of the water resource and to encourage conservation.

Conservation

Conservation of water provides an initial hedge against the possibility of future water-supply problems. It also makes economic sense.

The pro-conservation public policy exhibited by the FCES is shared by all the governmental agencies concerned with potable water. This public policy cannot be justified solely on the basis of scientific evidence. As documented above, technical experts have not yet been able to determine accurately the amount of water available in the Floridan Aquifer and the amount which safely can be withdrawn without endangering its quality.

The two most commonly articulated alternative justifications for water conservation are the following:

- Since scientific knowledge is incomplete, the only safe presumption is that the Floridan-Aquifer resource may in fact be limited and that conservation may be necessary. To assume otherwise would be foolhardy, since the valuable resource might be lost while awaiting proof of its limits.

- Even if the supply of water is plentiful, conservation makes economic sense because of verifiable costs associated with the production and use of additional amounts of potable water. These include the cost of:

  - increased energy consumed to treat and pump both potable water and wastewater;
  - possible environmental damage caused by facility construction, wastewater-disposal problems, and localized overdrawing from wells;
  - possible premature construction of new water and wastewater facilities, or over-construction to meet unnecessarily high peak-demand levels; and
  - possible premature shifts to higher levels of water treatment or to alternative sources of water.

Programs to promote water conservation include three components--education, incentives, and regulation.

Education is considered essential to make water users aware of the desirability of conservation and to gain their acceptance of the behavioral changes required to achieve conservation. However, experience has

shown that little conservation results from an educational campaign alone. For most users, incentives or regulations must be implemented to elicit actual behavioral change.

The education aspects of water conservation programs have tended to focus on the residential water uses of individual consumers. Some efforts are directed toward children in schools. In Jacksonville, public-school children are reached by the City Water Division's education program.

Other education efforts are aimed at adults. One effective strategy is to offer home water audits. In Jacksonville, these are provided on request at no cost to the consumer by Jacksonville Electric Authority staff. An abbreviated water audit is offered in conjunction with energy audits. A more intensive water audit is also available on request, with or without an energy audit. During this audit, consumers are helped to identify leaks, given inexpensive conservation fixtures such as faucet washers and shower-head flow restrictors, and offered useful information.

Some effective ways of conserving water in the home include retrofitting toilets and showers with inexpensive flow-reduction devices, identifying and fixing leaks, especially toilet leaks, and taking care not to run water when not actually needed. Since residential use is split about evenly for most consumers between inside and outside uses, conservation in the watering of lawns and washing of cars is as important as conservation in the brushing of teeth and rinsing of dishes.

In Duval County, about 41 percent of the groundwater consumed is used for residential purposes. Thus a conservation program which concentrates only on residential users may be limited. To be fully effective, some education efforts must also be directed toward large users engaged in agricultural irrigation and industrial processes.

Education can also effectively promote landscaping practices which conserve water. Xeriscape is a method of selecting plants for landscaping based on characteristics of the specific site. One of the factors considered is efficiency of irrigation. Xeriscape is now being promoted for both residential and commercial-industrial landscaping and may have some value in conserving water.

Incentives and regulations seek more directly to influence the behavior of water users. Incentives are generally instituted through the rates charged by water utilities. An inverted or conservation rate provides a lower rate for lower levels of consumption. The Tampa, Florida public water utility instituted a conservation rate late in 1989, along with other conservation efforts, and reported a 7 percent decline in water use during 1990. In some cities, seasonal surcharges are added to regular rates during periods of high consumption, which are typically dry seasons when lawn irrigation is heavy. The Jacksonville Water Division's current rate study includes consideration of an inverted rate.

Regulation to conserve water is not new in Florida. The SJRWMD restrictions on lawn irrigation in Northeast Florida have been in effect for some time and are proposed to be made permanent. Plumbing codes have been revised in some localities to require the installation of low-flow fixtures in new or renovated homes. Some local landscape ordinances also have been revised to require efficient water use.

Regulatory agencies maintain that enforcement is essential for success, implying that conservation behavior may not occur without the threat of a penalty for noncompliance. On the other hand, many individuals deplore the resulting government regulation of private lives.

In practice, the regulatory activities of government agencies are directed more toward large water systems and users than toward private individuals. The SJRWMD is now requiring all holders of new and renewal consumptive-use permits to reuse reclaimed wastewater for irrigation, if it is available. These permit holders are also being required to develop and implement conservation plans. In addition, state law requires inclusion of a water-conservation element in local comprehensive plans.

Some large water users have voluntarily sought to conserve water. They are motivated by economic incentives to reduce costs. For example, in 1974, Jefferson Smurfit Corporation used an average of 40 million gallons per day (mgd) of groundwater at its Fernandina Beach pulp and paper mill and 27 mgd at its Jacksonville mill. By 1990, the company had reduced water use to 15 mgd and 7 mgd respectively by systematically improving its manufacturing process to include multiple reuses of water. Similarly, Union Camp's plant on Jacksonville's Westside has reduced water use from about 4.7 mgd in 1967 to 2.9 mgd in 1990.

Meanwhile, large agricultural users have been improving their irrigation technology to conserve water. Farmers in the St. Johns, Flagler, and Clay tri-county area, which is dominated by potato production, have been shifting from spray and open-ditch irrigation to piped, ground-flow irrigation. This method requires major investments in pipe but conserves water by delivering it more directly to the roots of the plants, greatly reducing water loss. Some growers have developed methods of collecting remaining surface water at the low end of rows and pumping it back to the high end for reuse, further minimizing runoff loss.

Free-flowing wells represent a significant source of wasted water. To conserve water, Florida law requires property owners to cap or plug free-flowing wells. However, many property owners may not be aware of long-abandoned wells on their property, especially if their water flows into streams or lakes. Other free-flowing wells have been discovered on public property. Because of these situations, the SJRWMD recently began providing limited financial assistance to certain local governments, including Jacksonville, to identify and cap free-flowing wells. Because it is difficult both to locate and to cap these wells, and because funding is quite limited, the process is expected to take years.

In the Tampa Bay area and in South Florida, impending water-supply problems have prompted the development of extensive water-conservation programs.

Some cities have developed high-profile, integrated water-conservation programs aimed at educating the public and achieving substantial reductions in water use. An ambitious example is the program developed in 1989 by the Tampa Water Department. It includes:

- revision and enforcement of plumbing, landscape, and irrigation codes;
- development of an intensive residential retrofitting program which encourages residents to install flow restrictors in household fixtures;
- implementation of a conservation rate;
- promotion of Xeriscape; and
- education about water conservation through both the schools and the media.

As a result of these efforts, overall water use declined 7 percent during 1990; dry-season water use declined 15 percent; and peak-day water use declined 18 percent. Tampa officials are delighted with the results. They

also are gratified that support for the program has been widespread among Tampa citizens.

Residents of the Tampa Bay area have more reason than those in Northeast Florida to be concerned about an adequate water supply. Perhaps for this reason, no local government in Northeast Florida has developed an integrated water conservation program as ambitious as that being implemented in Tampa.

South Florida also is experiencing serious potable water problems and has responded with conservation measures. The South Florida Water Management District (SFWMD) has implemented a six-point conservation plan. Although similar in content to the City of Tampa plan, all of its provisions are mandatory, including:

- landscaping by Xeriscape in all new developments;
- prohibition of irrigation between the hours of 9 AM and 5 PM;
- installation of ultra-low-flow fixtures in all new developments;
- use of conservation rates by all water utilities;
- implementation of a leak-prevention program by all water utilities; and
- implementation of a public-education program by all water utilities.

The Xeriscape requirement is expected to reduce water use for landscape irrigation by about 25 percent in new developments. The other five requirements combined are expected to reduce overall water consumption by 10 to 15 percent.

Alternative Sources

Although Northeast Florida's water supply is superior in quantity and quality to that in South Florida, conservation alone may not suffice even here to ensure a continuing adequate water supply. Water reuse, dispersion of well fields, and planning for potential alternative sources of water, combined with conservation, can provide greater assurance of an adequate supply into the future.

If conservation of the existing water source is insufficient, communities may have to seek alternative sources. In much of South Florida, this necessity has arrived already. In Northeast Florida, plentiful, high-quality groundwater remains available. Nevertheless, public officials and technical experts advise that steps should be taken now, before a water crisis arrives, to conserve, to maximize the life of the existing water source, and to plan for the potential future need of alternative sources.

Developing Reuse Capabilities

Reuse of water provides an alternative source for nonpotable uses, while conserving the existing source for potable uses. In some industrial processes which require great quantities of fresh water, such as those used in Northeast Florida's pulp and paper milling industry, water can profitably be reused multiple times. For example, the industrial process at Jefferson Smurfit's Jacksonville mill reuses water 131 times.

Irrigation is another use which requires fresh but not necessarily potable water. Currently, the only major reuse of water for irrigation comes from industry. The Anheuser-Busch plant in Jacksonville irrigates a sod farm with wastewater effluent from its industrial operation.

Pollution-control laws regulate the quality of wastewater effluent. Wastewater treatment plants in Northeast Florida are required to provide at least a secondary level of treatment to the effluent they discharge into surface water. Some treatment beyond the secondary level is required to make wastewater usable for irrigation.

Reusing the water reclaimed from the wastewater-treatment process has the potential to conserve large quantities of water. In 1988, groundwater consumption in Duval County was about 170 mgd, while the amount of wastewater discharged was about 90 mgd. If all of that wastewater had been reused, original water consumption would have been cut in half.

Cost factors intervene, however, to make total reuse of wastewater unlikely. Reuse is expensive because it requires installing a separate piping system not connected to the potable system. Reclaimed water can be used most cost-effectively for large-scale irrigation in locations near wastewater treatment plants. In urban areas, golf courses most closely fit these conditions. Installation of a separate distribution system for residential lawn irrigation is quite expensive but is feasible in some new residential areas which have a nearby source of reclaimed water.

An unresolved issue concerns who should pay the costs of making reclaimed water available to particular users. Because of the magnitude of these costs, the users cannot normally be expected to bear the full burden alone. Instead, the costs will have to be spread among all users of the water and wastewater utilities involved. If costs are to be shared in this manner, water reuse capabilities may not be widely developed until water problems become sufficiently visible to convince people of the need to pay higher water bills.

Alternatively, government agencies may intervene with regulations to stimulate reuse development, in order to conserve potable water. This already is occurring in Northeast Florida. The SJRWMD is now placing reuse requirements new and renewal consumptive-use permits, including recent renewal permits issued to the Jacksonville Water Division. In addition, DER soon will be requiring wastewater treatment facilities located in critical water supply problem areas to make effluent available for reuse. The SJRWMD is expected to designate these areas before the end of 1991. Increasingly stringent regulations for discharge of effluent into surface water provide an additional incentive for wastewater treatment facilities to cooperate in the development of reuse capabilities. The Jacksonville Water Division intends initially to make reclaimed water from the Mandarin wastewater treatment plant available for residential and golf-course irrigation in the Mandarin/Southside area.

Dispersing and Limiting Withdrawal

Apart from conserving and reusing water, the most important means of maximizing the life of the Floridan-Aquifer water source is to reduce the possibility of salt-water intrusion. Withdrawing water from the upper level of the Floridan Aquifer, dispersing large wells, and limiting withdrawal from these wells can assist in accomplishing this. Each helps to reduce the upward seepage of saline water from the lower level of the Floridan Aquifer in particular areas of overwithdrawal.

In Duval County, potential and actual areas of overwithdrawal are located along the Atlantic coast and the St. Johns River. The Jacksonville Water Division has recently contracted for a master water plan, which will include consideration of developing new, dispersed well fields in the western part of the county.

Dispersing well fields will require the acquisition of land for well heads and right of way, as well as the construction of the wells and new pipelines to transport the water to treatment plants. The expenses involved will inevitably increase the cost of water for all customers (see page 8). Many years of effort will also be required, because of the lengthy time periods needed for land acquisition and approval of consumptive-use permits.

Deciding properly how to disperse wells and limit withdrawals requires obtaining detailed knowledge of the movements of the groundwater in the county and developing a groundwater management plan. The SJRWMD presently is developing a general model for establishing a groundwater management plan. Unfortunately, the most critical aspect of the model--the segment relating to salt-water intrusion--will not be completed for perhaps two or three years. In addition, the model will provide only a framework for analysis. Jacksonville water officials will still have to gather and enter a large amount of data from Duval County in order to apply the model locally.

Planning for Alternative Sources

Planning for possible alternative sources of water requires even more time and effort than planning for dispersal. For this reason, consideration of alternative sources cannot be ignored until a serious water problem emerges.

The St. Johns River appears to be the most likely alternative source of potable water in Northeast Florida. It conducts about 3.9 billion gallons of water per day to the Atlantic Ocean. Because it is a tidal river, however, the quality of the water in its lower estuary differs from place to place and hour to hour. At some point upstream of Jacksonville, fresh water from the St. Johns River could be diverted and piped for treatment and use in Duval County. This alternative would require no change of treatment methods from those used now on groundwater. However, it would increase costs, because the water would have to be transported quite a distance (see page 8).

An additional problem with using fresh river water would be difficult to solve. Tannin from vegetation in the swamps from which the river's waters originate colors the water brown. Although harmless, brownish water would not be attractive for potable uses. The tannin cannot be removed from the water inexpensively or easily.

Alternatively, brackish water from the St. Johns River in Duval County could be made potable by using a treatment called reverse osmosis. This option would eliminate all or most of the transportation cost but would greatly increase the treatment cost (see page 8). Reverse osmosis might not even be feasible in the tidal flow of the St. Johns, because successful use of this technology requires the availability of a constant quality of water, whatever that quality is.

The most abundant source of water is, of course, the ocean. However, it is many times more saline than the brackish water of the St. Johns River. This would make reverse-osmosis treatment much more costly. A study done recently for the town of Palm Beach indicated that the cost of treating seawater would be about $205 per customer per month, more than double the cost of treating brackish water. Since the St. Johns River offers such a copious source of surface water, even if it is brackish and brownish, considering the treatment of seawater for potable use in Northeast Florida seems extremely farfetched.

The second part of the Jacksonville Water Division's master water planning process will consider long-term options for alternative-water-source development in Duval County. Once this plan is complete, it should help to guide future strategies for the potential development of alternative sources, in case efforts to conserve the Floridan-Aquifer source fall short.

CONCLUSIONS

Conclusions express the value judgments of the committee, based on the findings.

1. Since the Floridan Aquifer is a valuable resource of abundant and high-quality water, which can be made potable with minimal treatment and expense, all prudent steps should be taken to protect it.

2. Preventing salt-water intrusion is critical for maintaining the quality of Floridan-Aquifer water. It requires limiting the quantity and rate of withdrawal in particular locations, especially from wells concentrated along the St. Johns River and Atlantic coast. Developing new wellfields in the western part of Duval County and dispersing wells may be effective means of reducing withdrawal from these wells.

3. Northeast-Florida water users cannot assume that Floridan-Aquifer water will always be reserved for their use alone. Substantial and growing water shortages in the South Florida and Tampa Bay areas may encourage efforts to gain access to Floridan-Aquifer water.

4. Water from the Floridan and shallow aquifers must be protected from contamination resulting from backflow of materials into wells and from leaking of contaminants from malfunctioning septic tanks, old dumps, underground tanks, retention ponds, and similar sources.

5. Recharge areas for the Floridan Aquifer in Northeast Florida must be protected through land-use restrictions and other incentives relating to development.

6. Insufficient progress is being made to cap the numerous abandoned artesian wells in Northeast Florida, which waste large quantities of Floridan-Aquifer water.

7. Significant progress made by some industrial water users to reduce consumption of Floridan-Aquifer water and to reuse water many times is commendable and deserves recognition.

8. Uncontrolled drilling of small, private wells into the Floridan Aquifer for nonpotable uses, when lower-quality water is available from shallow aquifers and surface streams, counters efforts to conserve Floridan-Aquifer water for potable purposes.

9. Northeast-Florida counties do not have a coordinated, regional water-conservation program.

10. An extensive and ongoing education program on water conservation is one effective strategy to conserve potable water.

11. Residents of the coastal counties in Northeast Florida may not be sufficiently aware that the rain which falls on them cannot replenish the Floridan Aquifer from which they drink; therefore, they may not be influenced to conserve.

12. Xeriscape, a method of landscaping which is sensitive to plant-watering needs, has potential as one means of conserving water used for irrigation.

13. Reuse of wastewater is an underutilized source which can help to conserve Floridan-Aquifer water.

14. Encouraging the installation of low-flow appliances and fixtures can help to conserve potable water, especially in residential use.

15. Water-utility rate structures which charge lower rates for greater consumption lack incentives needed for water conservation.

16. Public perception that the St. Johns River Water Management District has used a double standard in its water-use restrictions (mandatory for individuals; voluntary for industry and agriculture) has confused many people and affected their willingness to cooperate with needed water-conservation measures.

17. Potable-water planning is inhibited by lack of sufficient long-term data and by untimely reporting of data by the St. Johns River Water Management District. At present, planners are awaiting the release of important data from the inventories of 1989 and 1990 water uses, the needs and sources study, the minimum levels study, the designation of critical water supply problem areas, and the designation of prime recharge areas.

18. To improve potable-water planning and decision making, continuing research is needed to understand the dynamics of water in the Floridan Aquifer, especially the quantity of water available and the amounts which can be withdrawn without jeopardizing the quality of the water.

19. Because many well owners are not required to measure and report usage, water planners and regu-

lators must base decisions on estimates whose accuracy is questionable.

20. To be effective, the regulation of water use must be based on consideration of regional water-use impacts, not solely on the impact of each permitted use.

21. Insufficient incentives are being offered which encourage using water from shallow wells and reclaimed wastewater for nonpotable uses, so as to conserve Floridan-Aquifer water primarily for potable uses.

22. The large number of agencies and utilities involved in various aspects of potable-water regulation and production appears to reduce their effectiveness because of overlapping responsibilities and problems with coordination.

23. Potable water has been available in Florida for only the cost of treatment and distribution. Thus, water users may be insufficiently aware of the real value of this limited resource and may discount that value by using water inefficiently.

24. Especially in publicly-owned water utilities, rates are not updated frequently enough to maintain full coverage of costs for both operations and capital maintenance and improvement.

25. While major efforts are needed to conserve the Floridan-Aquifer water resource, planning must begin now to ascertain the potential costs and benefits of feasible alternative sources of potable water.

RECOMMENDATIONS

Recommendations are the committee's specific suggestions for change, based on the findings and conclusions.

1. The St. Johns River Water Management District should evaluate all education programs on water conservation being offered in Northeast Florida and should develop an effective, coordinated education program for the region. Wherever possible, it should encourage the implementation of education programs through local agencies and utilities.

2. The Jacksonville City Council should designate a single agency to coordinate education programs for water conservation in Duval County.

3. The Florida Legislature should require all new water wells not now requiring a well-construction permit to obtain such a permit before drilling begins. The Legislature should designate a single, local agency in each county, such as the Water Resources Division in Jacksonville, to issue these permits.

4. All well-construction permits should require construction designs which effectively prevent groundwater contamination.

5. The St. Johns River Water Management District should immediately take the steps necessary to determine the amount of water being withdrawn from both shallow and Floridan Aquifers in Northeast Florida.

6. State and local regulatory agencies in Northeast Florida should expand their network of Floridan-Aquifer monitoring wells, in order to assess instances and patterns of salt-water intrusion.

7. Regional and local planning agencies in Northeast Florida should design and implement land-use regulations which will protect and enhance recharge areas of the Floridan Aquifer.

8. The St. Johns River Water Management District should more aggressively and rapidly pursue its program to identify and plug free-flowing wells in Northeast Florida.

9. The St. Johns River Water Management District should provide incentives which encourage the use of shallow-aquifer water, surface water, and reclaimed water for nonpotable purposes. They should publicly recognize and commend users who reduce consumption and/or increase reuse.

10. Regional and local planning agencies in Northeast Florida should encourage, as a part of the plan review process, the installation in new developments of a parallel pipe system for the reuse of treated wastewater for irrigation purposes.

11. The Florida Department of Environmental Regulation should amend its regulations to allow the reuse of appropriately treated wastewater in potable water systems, where such use is feasible and cost-effective.

12. The St. Johns River Water Management District should complete and publish as soon as possible a detailed study of sources and needs and/or a detailed aquifer model which simulates the movement of water in the Floridan Aquifer.

13. Using the sources and needs study and/or aquifer model as a guide, the St. Johns River Water Management District should base approval of consumptive-use permits on consideration of the full regional impact of each new water use, not solely on the proposed permitted use itself.

14. Water utilities in Duval County should disperse withdrawal of water from the Floridan Aquifer, to prevent salt-water intrusion. To accomplish this, they should develop new wellfields in western Duval County, with the necessary piping to populated areas, and reduce pumping from wells concentrated along the St. Johns River and Atlantic coast.

15. Building codes in Northeast-Florida communities should require the installation of low-flow appliances and fixtures in all new construction and major renovations, as a means of conserving potable water.

16. State and local regulatory agencies in Northeast Florida should intensify efforts to identify and require cleanup of groundwater-contamination sources such as malfunctioning septic tanks, leaking storage tanks, and old dumps.

17. Publicly and privately owned water utilities should establish rate structures which provide an incentive to conserve water. The Florida Public Service Commission should adopt and enforce a policy requiring the use of conservation water rates.

18. The Jacksonville City Council, and other local governments in Northeast Florida which govern publicly owned water utilities, should review water rates at least every three years to ensure that they continue to meet full costs and encourage conservation.

19. The Florida Legislature and local governments in Northeast Florida should clarify the responsibilities of state and local water-regulatory agencies to establish clear and distinct assignments of the various functions of water-use regulation and water-quality protection.

20. Local and state agencies which regulate water in Northeast Florida should extend informal cooperation already occurring in Duval County by establishing a regional water-resources council. The council should meet openly and encourage the participation of water users, including utilities, industries, agricultural operators, and the public.

21. The St. Johns River Water Management District should improve and expand its capabilities to collect, analyze, and report data, so that needed information will be available on a more timely basis for water planning purposes.

22. Water utilities and planning agencies in Northeast Florida should include studies in their long-range planning process of the feasibility, costs, and benefits of using possible alternative sources of potable water.

RESOURCE PEOPLE

The JCCI study process relies upon information supplied by knowledgeable resource people in addition to published reference materials. We wish to thank the following persons for their contributions to this study:

J. D. Benoit,
Smith and Gillespie
Engineers, Inc.

Tom Braddock,
Duval County office, Florida
Cooperative Extension Service

Richard Breitmoser,
Jacksonville Electric Authority

Mike Brown,
Northeast Florida Regional
Planning Council

Chris Carter,
Environmental Engineering
Division,
Jacksonville Department of
Health, Welfare, and
Bio-Environmental Services

Bill Cotton,
North Florida
Growers Exchange

John Davis,
Florida Department of
Environmental Regulation

Bruce Florence,
St. Johns River Water
Management District

Chuck Flowe,
Water Resources Division,
Jacksonville Department of
Health, Welfare, and
Bio-Environmental Services

Terry Fore,
Union Camp Corporation

Ernie Frey,
Florida Department of
Environmental Regulation

Pat Gleason,
James M. Montgomery
Consultants,
Lake Worth, Florida

Thomas Hamilton,
Environmental Engineering Division,
Jacksonville Department of
Health, Welfare, and
Bio-Environmental Services

Michael Hersey,
Smith and Gillespie
Engineers, Inc.

Ron Jenkins,
Jacksonville City Council member

Harold Jones,
Duval County office,
Florida Cooperative
Extension Service

Scott Kelly,
Water Division,
Jacksonville Department of
Public Utilities

Gary Kresel,
Jacksonville Department of Planning

Warren Leve,
G.W.L. Environmental Consultants

Rick Levin,
St. Johns River Water
Management District

Gary Lynne,
Food and Resource
Economics Department,
University of Florida

Kathryn Mennella,
St. Johns River Water
Management District

Dave Miracle,
St. Johns River Water
Management District

Wendy Nero,
Water Conservation Manager,
Tampa Water Department

Jerry Owen,
Florida Department of
Environmental Regulation

Tim Perkins,
Water Division, Jacksonville
Department of Public Utilities

Blanca Rodriguez,
Florida Department of
Environmental Regulation

M. Sambamurthi,
Jacksonville Suburban Utilities

Terrie Shuman,
St. Johns River Water
Management District

Clark Vargas,
Jacksonville Environmental
Protection Board

Warren Viessman Jr.,
College of Engineering,
University of Florida

Gary Weise,
Water Resources Division, Jacksonville
Department of Health, Welfare, and
Bio-Environmental Services

Naomi Whitney,
St. Johns River Water
Management District

Bob Williams,
Jefferson Smurfit Corporation

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COMMITTEE MEMBERSHIP AND WORK

Committee members met together on 25 Thursday afternoons from October through April. In addition, the Management Team met several times to provide guidance and direction for the study. The committee received information from 34 knowledgeable resource persons and additional written materials researched by JCCI staff.

Chairman: Russell B. Newton Jr.

MANAGEMENT TEAM

Dale Clifford
Betty Davis
Mike Hersey
Dale Joyner
Warren Leve
Howard Serkin

Barbara Jeanne Bald
Nancy Barnard
Don Bayly
Ken Berk
Tom Bott
Rita Braunegg
Stafford Campbell
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John Searles
Phil Steinke
Caroline Swain
Daniel Usdin
Gary Weise
Glen Williams
Robin Wind-Faillace

JCCI STAFF

Marian Chambers, Executive Director

PROFESSIONAL

Barbara Bowman
Sharon Duke
Donnelly Rembert
*David Swain

SUPPORT

*Teddy Scott
*Sandra Simmons
Barbara Tingley

*Responsible for this study

JACKSONVILLE COMMUNITY COUNCIL INC.

Jacksonville Community Council Inc. (JCCI) was formed to anticipate, identify, and address the complex issues of urban life. JCCI is a community-based nonpartisan, nonprofit organization providing the vehicle for in-depth, objective, citizen analysis of community problems and issues. It seeks broader community awareness and understanding of the issues and provides Jacksonville a diverse citizen forum reaching across the traditional dividing lines of a complex and diverse urban community.

The primary goal of JCCI is a better quality of life in Jacksonville through positive change. It has an impressive record for the quality, objectivity, clarity, and practicality of its studies of community problems, and its advocacy for the solutions it develops. Jacksonville has experienced the benefits of numerous improvements growing from these citizen studies. Through its support of the Human Services Council and work for the United Way, JCCI promotes the planning and coordination of human services.

JCCI is founded on a deep faith in the ability of citizens to set aside their differences and join together to learn and reason about problems of mutual concern. Its growth and success offer renewed hope for this basic democratic concept as a means of addressing the complex issues of modern urban communities.

JCCI receives funding from the United Way of Northeast Florida, the City of Jacksonville, corporations, foundations, and individual members.

Individual members are the life blood of JCCI. Persons interested in becoming members may call the office at 396-3052 or write to JCCI at 1001 Kings Avenue, Suite 201, Jacksonville, Florida 32207.

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*These studies are out of print.

Jacksonville Community Council Inc.
1001 Kings Ave., Suite 201
Jacksonville, FL 32207

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